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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|--|-------------|----------------------|---------------------|------------------|
| 10/649,613 | 08/28/2003 | Yoshihisa Fujisaki | NITT.0154 | 5282 |
| 38327 | 7590 | 02/24/2005 | EXAMINER | |
| REED SMITH LLP 3110 FAIRVIEW PARK DRIVE, SUITE 1400 FALLS CHURCH, VA 22042 | | | | RICHARDS, N DREW |
| | | ART UNIT | | PAPER NUMBER |
| | | 2815 | | |

DATE MAILED: 02/24/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. | Applicant(s) | |
|------------------------------|------------------------|---------------------|--|
| | 10/649,613 | FUJISAKI ET AL. | |
| | Examiner | Art Unit | |
| | N. Drew Richards | 2815 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) Responsive to communication(s) filed on 28 January 2005.

2a) This action is **FINAL**. 2b) This action is non-final.

3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) Claim(s) 1-16 is/are pending in the application.
4a) Of the above claim(s) 5-16 is/are withdrawn from consideration.
5) Claim(s) _____ is/are allowed.
6) Claim(s) 1 is/are rejected.
7) Claim(s) 2-4 is/are objected to.
8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) The specification is objected to by the Examiner.

10) The drawing(s) filed on 28 August 2003 is/are: a) accepted or b) objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) All b) Some * c) None of:

1. Certified copies of the priority documents have been received.

2. Certified copies of the priority documents have been received in Application No. 09/984,632.

3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) Notice of References Cited (PTO-892)
2) Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 8/28/03.

4) Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
5) Notice of Informal Patent Application (PTO-152)
6) Other: ____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of Species I (claims 1-4) in the reply filed on 1/28/05 is acknowledged.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Huang (U.S. Patent No. 6,368,923 B1) in view of Narwankar et al. (U.S. Patent No. 6,337,289).

Huang teaches a process for producing a semiconductor device in figures 1A-1G and on columns 1-6. Specifically, Huang teaches:

- a step of forming a gate insulator 118 on a silicon substrate 100 (figure 1D; substrate is silicon as taught on column 2 lines 66-67); and
- a step of forming a gate electrode 124a (figure 1G), a source electrode 108a and a drain electrode 108a on the silicon substrate 100 (figure 1A shows the source/drain electrodes 108a; though not explicitly named an electrode, silicide layer 108a of Huang is considered an electrode as it is a conductive structure that allows electrical contact to the source/drain regions);
- wherein the step of forming the gate insulator 118 includes

- o a first step of forming a silicon nitride film 118 on the surface of the silicon substrate 100 (column 3 lines 37-50).

Huang does not explicitly teach irradiating nitrogen radicals to the substrate from a radical nitriding apparatus. Nor does Huang teach the nitriding apparatus being provided with a plasma chamber for generating nitrogen plasma including the nitrogen radicals, a substrate susceptor provided outside the plasma chamber for supporting the silicon substrate, and ion deflecting means provided between the plasma chamber and the substrate susceptor. Huang teaches forming the silicon nitride layer 118 using remote plasma nitridation.

Narwankar et al. teach a method and apparatus for remote plasma nitridation. Narwankar et al. teach that a remote plasma nitriding apparatus 301 is provided with a plasma chamber 310 for generating nitrogen plasma including nitrogen radicals, a substrate susceptor 354 provided outside the plasma chamber 310 for supporting the silicon substrate 351, and ion deflecting means 314 provided between the plasma chamber 310 and the substrate susceptor 354. See column 3 line 12 through column 4 line 26. The conduit 314 is considered "ion deflecting means" as the conduit deflects all species in the plasma to direct them towards the process chamber 350, thus ions in the plasma are deflected towards the process chamber. Narwankar et al. teach that in using the remote plasma nitridation apparatus 301, nitrogen radicals are created and are irradiated to the substrate. Narwankar et al. teach that electrically neutral, highly reactive atoms flow into chamber 350 (and thus to the substrate such that they are

"irradiated" to the substrate). It is noted that electrically neutral, reactive atoms are radicals.

Huang and Narwankar et al. are combinable because they are from the same field of endeavor. At the time of the invention it would have been obvious to a person of ordinary skill in the art to use the remote plasma nitriding apparatus of Narwankar et al. in the process of Huang. The motivation for doing so is that the apparatus of Narwankar et al. produces a product gas that is highly reactive but no longer electrically damaging to the substrate (Narwankar et al. column 4 lines 15-18). Therefore, it would have been obvious to combine Huang with Narwankar et al. to obtain the invention of claim 1.

Allowable Subject Matter

4. Claims 2-4 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

5. The following is a statement of reasons for the indication of allowable subject matter: the prior art of record fails to teach, disclose, or suggest, either alone or in combination, the process as claimed including:

- the ion deflecting means being ion deflecting electrodes (as recited in claim 2); or
- generating more atomic nitrogen radicals than N_2 radicals in the plasma chamber (as recited in claims 3 and 4).

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Kraft et al. (U.S. Patent No. 6136654), Raaijmakers et al. (U.S. Patent No. 6348420 B1), Kawakami et al. (US 2002/0111000 A1), Yieh et al. (US 2002/0119673 A1), Hattangady et al. (U.S. Patent No. 6399445 B1), Niimi et al. (U.S. Patent No. 6610614 B2), JP 200269483 A, JP 58040833A.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to N. Drew Richards whose telephone number is (571) 272-1736. The examiner can normally be reached on Monday-Friday 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (571) 272-1664. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


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